REMARKS

Drawings

Applicant notes the Office Action Summary did not indicate the whether the Examiner had accepted or rejected the drawings filed as part of the original International Application, of which this is a US National Phase, having entered the National Phase on February 21, 2007.

Claims Rejections - 35 USC §112 Second Paragraph

The Office rejected Claim 13 under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. A §112 second paragraph rejection has two separate requirements, indefiniteness and failing to claim what applicant regards as the invention. With respect to indefiniteness, the "essential inquiry pertaining to this requirement is whether the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity. Definiteness of claim language must be analyzed, not in a vacuum, but in light of (1) the content of the particular disclosure, (2) the teachings of the prior art, and (3) the claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made." (MPEP §2173.02).

The applicant has amended claim 13, removing the language deemed by the Office to lack antecedent basis. The applicant respectfully submits that this amendment cures the Office's rejection. The applicant therefore requests that the Office withdraw its rejection of claim 13.

Claims Rejections - 35 USC §102(b)

The Office rejected claims 1-11, 13-19, 21-28, 30, 33-38 under 35 U.S.C. 102(b) as being anticipated by US Patent No. 6,257,168 issued to Ni *et al*. A rejection based on anticipation requires that a single reference teach every element of the claim (MPEP § 2131). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Or stated in another way, a "claim is anticipated only if each and every element as set forth in the claim is found, . . . described in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). . . .

The applicant has carefully reviewed the cited reference and respectfully disagrees with the Office. In particular the applicant submits that the cited '168 reference fails to disclose several elements of the claimed invention, and therefore the '168 reference does not anticipate the claimed invention.

The applicant respectfully submits that the claimed invention is provided to increase the rate at which substrates can be process. Other attempts to increase the rate of processing, and the inherent problems associated with such attempts are described in the application:

> **[0006]** In some prior art systems (such as that disclosed in WO02/056333), an expansion region is provided by the provision of a large chamber adjacent the plasma generation region. Such an expansion chamber provides for the homogenisation of the species generated within the plasma. Whilst this has some positive effects with regard to the uniformity of the treatment upon the substrate surface, it is often detrimental to the treatment rate, adds to the cost of the equipment and complicates the set-up procedure associated with the apparatus.
>
> **[0007]** There is therefore an ongoing desire within the industry to provide improved apparatus with higher process rates whilst maintaining the uniformity of the treatment effect upon the substrate.

The applicant submits that the claimed invention seeks to address these problems, and as evidenced by the experiments described beginning in Paragraph 0075. The applicant respectfully submits that the cited reference fails to provide the elements whereby this improvement is achieved and furthermore would not be equipped, as alleged by the Office to perform the claimed method.

The cited '168 reference, in contrast to the claimed invention seeks to improve etch uniformity rather than processing speed. As illustrated in Fig. 5 of the cited '168 reference, that reference addresses the issue of etch uniformity by the introduction of a uniformity ring. The uniformity ring of the '168 reference has internal walls with straight walls, i.e. walls perpendicular to the base of the ring, and outwardly sloping external walls, i.e. walls with a greater external diameter at its base than at its top. The placement of the uniformity ring of the cited reference is illustrated in Figure 4 of the cited reference. The Applicant notes that the '168 reference discloses that gas flow is directed away from the substrate 410. Such a configuration is in contrast to the claimed invention which provides:

> . . . a guide for directing the gas flow containing the species towards said substrate to be treated, said guide defining a path through which said at least one gas and said at least one species flow from said plasma generating region to said substrate;
> **said guide having an entrance and an exit, said entrance having a second width and being disposed proximal to said plasma generating region, said exit having a third width and being disposed proximal to said substrate to be treated;**
> **said second width being greater than said first width, and said third width is less than said first width, said guide being configured such that at least one gas is directed toward said substrate to be treated.**

Thus the claimed invention, in contrast to the cited reference directs gas flow through the guide and towards the substrate by a guide that has an inward slope. The cited reference directs gas

flow away from the substrate by means of a uniformity ring that deflects gas flow from the substrate.

In further contrast to the claimed invention, the cited reference teaches that the plasma is disposed centrally in the chamber. The '168 reference fails to disclose modification of the shape of the plasma generation region of the use of a peripheral plasma generation region, as is provided by the guide of the claimed invention:

> [0022] The guide allows the width of the plasma (that is, its lateral dimension) to be greater than that of the substrate. The difference between the width of the plasma and the substrate defines an "outer region" of the plasma. The guide directs the species from at least this outer region onto the substrate. The advantage of this is that, because of the skin effect (in the case of electromagnetic generation) or plasma sheath effects (in the case of powered electrodes), the majority of the energy from the plasma generator couples to the plasma in a peripheral "active" region. In practice this region ordinarily extends inwards from the periphery of the plasma by a few centimeters. It is therefore desirable to direct the species from the most active region (where their concentration is highest), directly onto the substrate by the use of the guide. The nature of the active species may change in transit from the active region to the substrate: either original or derived species may have useful effects on the substrate. [Claimed invention]

The applicant respectfully submits that this peripheral plasma generating area, provides the "the species generated substantially at or adjacent the periphery of the plasma" (Claim 2, and corresponding to "the widths defining an outer region of plasma, and wherein the species are directed from substantially all of the outer region, towards the substrate" of Claim 25.) The applicant respectfully submits that this is not provided by the cited '168 reference, where the angle of the uniformity ring directs these peripheral plasma generated species away from the species.

The applicant appreciates the Office's reminder as to the need to distinguish apparatus and systems claims based on structural distinctions. The applicant respectfully submits that those elements discussed above indeed relate to key structural differences between the cited '168

reference and the claimed invention. The applicant submits that the those elements dismissed by the Office as function, in this case have a significant impact on the structure of the claimed invention and respectfully submits that the amendments to the claims highlight these distinctions. The applicant submits that the functional distinctions discussed here are important in highlighting those distinctions and emphasize that the cited reference, being configured for distinct goals and unsuitable for the function of the claimed invention is configured differently from the claimed invention.

The applicant respectfully submits that the uniformity ring of the cited reference has been adequately distinguished from the guide of the claimed invention, having not merely a different configuration, but one that is actually the reverse of the claimed invention.

The guide in the present claim 1 is therefore not equivalent apparatus to the ring in the '168 reference. In the '168 reference there is consideration of the lateral thickness of the uniformity ring (see column 5 lines 16 to 19 of the cited '168 reference) although the taught purpose of this is to prevent diffusion from a higher concentration region towards the substrate edge. The guide of the present invention is not managing diffusive effects, it is managing gas flow.

In column 7 lines 42 to 48 of the cited reference there is discussion of the etch rate being determined by how fast the species are brought to the substrate and how fast the resultant gases are removed. The teaching here, in contrast to the claimed invention is that a gap between the bottom of the ring and the substrate can be used as a conduit to remove gases from the substrate region. The '168 reference prefers that the "inner periphery of the surface of the uniformity ring be perpendicular to the bottom electrode" (a simple cylindrical bore). The applicant respectfully submits that either with or without the uniformity ring being present in the '168 reference, the etch rate in the central portion of the substrate would be substantially the same. While at column 8 in the '168 reference there is a discussion of other geometries for the inner walls, these are clearly directed at controlling the etching at the edge of the substrate only. The entire purpose of the uniformity ring, as indicated by its name, should be recalled in this context.

The independent claim 1 clearly distinguishes over the uniformity ring of the '168 reference due to the relative sizes of the plasma generation region, the width of the entrance of the guide and that of the exit of the guide. Specifically, the plasma which contains the species in the present claimed invention is formed in a region which is outside the substrate, indeed this is in the peripheral region of the chamber between the walls and the first width. The applicant respectfully notes in particular that, as is claimed, the shape defined by the exit opening (third width) would sit "inside" the inner boundary of the plasma generation region (first width) without the two regions being overlapped. In contrast to the '168 reference, in the present invention the plasma is generated within the peripheral parts of the chamber and this is then concentrated, by the guide, onto the substrate. The plasma generation region therefore has a larger area in comparison with the substrate than is the case in the '168 reference (see page 3 line 34 of the present application). The increased area and the active nature of this region can be seen to improve the etch rate by 100 %. The applicants have therefore realized that the generation of the species in the peripheral regions of the chamber can be used to positive effect by the capture and directing of these onto the substrate. The gas flow system is used to drive the flow of gases within the chamber to ensure a good etch rate. Similarly, independent claim 25 recites a method using peripherally generated species :"with a guide having a opening proximate to said plasma generating region having a diameter greater than that of an opposing opening proximate to said substrate; wherein the width of the plasma in use is greater than that of the substrate, the difference between the widths defining an **outer region** of plasma, and wherein **the species are directed from substantially all of the outer region, towards the substrate**." Elements manifestly absent from the cited reference.

Specifically with regard to claim 3, the applicant respectfully submits that the cited 168 reference fails to disclose a deflector device, and that which is alleged by the Office to be a "deflector device" is a "gas injector" or "ports built into the walls" and is not analogous to the deflector device of the claimed invention. The claimed deflector device directs gases to the active region of the plasma, which is present around the periphery of the chamber as the plasma generation region. Claim 3 has been amended accordingly to clarify the presence of an inlet and a deflector (see Figure 1 reference numerals 15 to 17 and page 10 lines 21 to 28 of the PCT

publication). Referring to the '168 reference, the curved arrows shown next to the gas injector 310 (see Figure 3) do not indicate the presence of or the function of the deflector as claimed in claim 3.

Regarding the plasma termination device claimed in claims 9 to 12, while the Office alleges that the '168 reference discloses the content of these claims, The applicant respectfully submits that the '168 reference simply fails to disclose a structure that performs is a plasma termination device or that performs an analogous function. The applicant has amended claim 9 to clarify the claim, and to remove any confusion the Office may have and to specifically claim the position of the plasma termination device. The applicant respectfully submits that the cited reference does not disclose any plasma termination apparatus which attenuates the supply of electrically charged species to the substrate.

With reference to the prevention of stagnation points as recited in claims 7 and 37, the Office has relied upon Figure 3 of the cited '168 reference as a basis of his rejection. Each of these claims previously required a net flow of gas across the substrate. This means that the "centre of gravity" of the gas at two different instances in time moves across the substrate. The applicant respectfully submits that an interpretation of these claims to mean that there is some flow of gas across the substrate would not meet the requirement of a net flow. In order, however, to further clarify the claim the applicant has now amended claim 7 to further to require asymmetry within the guide or guide positioning and also a bulk flow across the substrate. The applicant submits that the cited '168 reference clearly does not disclose or contemplate such an arrangement and the resultant novel gas flow.

Finally, in claim 23, the Office has also referred to Figure 3 in Ni. The applicant strongly disagrees with the Office's contention that the ring meets the requirements of the claim. In addition to the fact that the ring does not function as the claimed guide, clearly the ring is not positioned close to the wall such that when it is heated is comes into contact with the wall. If the guide "comes into contact" upon heating then it cannot be in contact with the walls when at a lower ambient temperature.

The Office is respectfully reminded that "[t]o overcome the anticipation rejection, the Applicant needs to only demonstrate that not all elements of a prima facie case of anticipation have been met, i.e., show that the prior art reference cited by the Examiner fails to disclose every element in each of the applicants' claims. "If the examination at the initial state does not produce a prima face case of unpatentability, then without more the applicant is entitled to grant of the patent." In re Oetiker, 977 F.2d 1443, 24 USPQ 2d 1443, 1444 (Fed. Cir. 1992).

At least of those reasons recited above, the applicant respectfully submits that the claimed invention of claims 1-11, 13-19, 21-28, 30, 33-38, as amended, are patentably distinct from the cited '168 reference. The applicant respectfully requests that the Office withdraw it rejection of these claims.

Claim Rejections – 35 USC § 103

The Office has quoted the statute from 35 USC 103(a), which is referenced herein. The Office has rejected claims 12, 20, 29, 31, and 32 as being unpatentable over the '168 reference in view of other references. Applicant has carefully considered the Office rejections and respectfully submits that the amended claims, as supported by the arguments herein, are distinguishable from the cited reference.

According to the MPEP §2143.01, "[o]bviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found in either the references themselves or in the knowledge generally available to one of ordinary skill in the art."

A useful presentation for the proper standard for determining obviousness under 35 USC §103(a) can be illustrated as follows:

1. Determining the scope and contents of the prior art;

2. Ascertaining the differences between the prior art and the claims at issue;
3. Resolving the level of ordinary skill in the pertinent art; and
4. Considering objective evidence present in the application indicating obviousness or unobviousness.

The Office rejected Claim 12 under 35 USC 103(a) as being unpatentable over the '168 reference in view of US Pre-Grant Publication No. 20030082920 of Huang. The Applicant has carefully reviewed the cited references and respectfully disagrees. The applicant notes that claim 12 is dependant from claim 9, itself dependant from claim 1. The applicant respectfully submits that, as discussed at length above, the Office's allegations with regard to the '168 references similarity to claim 1 are incorrect in light the above arguments and amendments. The '920 reference is cited by the Office only for its disclosure of an inductive coil and magnet. The Office does not allege that the '920 reference discloses any of the other elements noted by the applicant as absent from the cited '168 reference, nor does the Office supply any basis for its summary statement that one skilled in the art would find the proposed combination obvious. The applicant respectfully reminds the Office that "…[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. *See Lee*, 277 F.3d at 1343-46; *Rouffett*, 149 F.3d at 1355-59." *In re Kahn* (Fed. Cir. 2006, 04–1616). Likewise "[t]herefore, in formulating a rejection under 35 U.S.C. 5 103(a) based upon a combination of prior art elements, it remains necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed." (*see* USPTO Memo May 30, 2007 from Margaret A. Focarino, Deputy Commissioner for Patent Operations)

The applicant respectfully submits that the claimed invention of claim 12 is patentably distinct from the cited references, either alone or in combination, and requests that the rejection of claim 12 be withdrawn.

The Office rejected Claim 20 under 35 USC 103(a) as being unpatentable over the '168 reference in view of US Patent No. 6,059,985 of Yoshimura. The Applicant has carefully

reviewed the cited references and respectfully disagrees. The applicant notes that claim 20 is dependant from claim 18, itself dependant from claim 1. The applicant respectfully submits that, as discussed at length above, the Office's allegations with regard to the '168 references similarity to claim 1 are incorrect in light the above arguments and amendments. The Office cites the '985 reference solely to provide for movable supports to provide a variable distance between the plasma and the substrate.

The Office does not allege that the '985 reference discloses any of the other elements noted by the applicant as absent from the cited '168 reference, nor does the Office supply any basis for its summary statement that one skilled in the art would find the proposed combination obvious. The applicant respectfully reminds the Office that "…[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. *See Lee*, 277 F.3d at 1343-46; *Rouffett*, 149 F.3d at 1355-59." *In re Kahn* (Fed. Cir. 2006, 04–1616). Likewise "[t]herefore, in formulating a rejection under 35 U.S.C. 5 103(a) based upon a combination of prior art elements, it remains necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed." (*see* USPTO Memo May 30, 2007 from Margaret A. Focarino, Deputy Commissioner for Patent Operations)

The applicant respectfully submits that the claimed invention of claim 20 is patentably distinct from the cited references, either alone or in combination, and requests that the rejection of claim 20 be withdrawn.

The Office rejected Claims 29, 31, and 32 under 35 USC 103(a) as being unpatentable over the '168 reference in view of US Patent No. 6,635,185 of Demmin. The Applicant has carefully reviewed the cited references and respectfully disagrees. The applicant notes that claim 29, 31, and 32 are dependant from claim 25. The applicant respectfully submits that, as discussed at length above, the Office's allegations with regard to the '168 references similarity to claim 25 are incorrect in light the above arguments and amendments. The Office cites the '185 reference sole to provide a method for etching that discloses that a chamber pressure, power and etching composition are plasma etching operation conditions that can have an effect on the results.

The Office does not allege that the '185 reference discloses any of the other elements noted by the applicant as absent from the cited '168 reference.

The applicant respectfully submits that the claimed invention of claims 29, 31 and32 are patentably distinct from the cited references, either alone or in combination, and requests that the rejection of claims 29, 31 and32 be withdrawn.

Applicant believes the above amendments and remarks to be fully responsive to the Office Action, thereby placing this application in condition for allowance. No new matter is added. Applicant requests speedy reconsideration, and further requests that Examiner contact its attorney by telephone, facsimile, or email for quickest resolution, if there are any remaining issues.

Respectfully submitted,

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